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(54) **AN APPARATUS FOR LOADING AND UNLOADING AIRCRAFTS**

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Description

Technical Field

[0001] The invention relates to an apparatus for loading and unloading aircrafts, where said apparatus comprises

a height-adjustable and tiltable first conveyor which is adapted to convey cargo between an area outside said cargo compartment and a second conveyor,

said second conveyor having a first end and a second end and being at least partially extendable from said apparatus into said cargo compartment, said second conveyor including a succession of conveyor units of which a first end conveyor unit is arranged at said first end,

wherein each conveyor unit has a set of wheels and wherein the conveyor units are mutually interconnected by means of coupling members that allow for a sideways mutual pivotal movement of said conveyor units.

[0002] In connection with the loading and unloading of small aircrafts, such as DC 9, MD 80's and Boeing 737 etc., viz. the so-called narrow body aircrafts, it is common knowledge that the work involved is very stressful to the persons involved. The latter is due to the facts that the time available is often very short and that the cargo compartment is of such a small size that the person in question must lie on his knees or sit down inside said cargo compartment while handling the luggage. Accordingly, a relatively high risk of physical damages applies.

[0003] Several suggestions have been made to facilitate the work in question. The use of any kind of auxiliary equipment is usually conditioned by said equipment being removed from the aircraft once the loading and unloading operations have been terminated because the weight of said auxiliary equipment has the effect that it cannot be left in the aircraft. In addition, the auxiliary equipment must be movable into and out of the aircraft in a relatively quick manner due to the rather short period available.

[0004] WO 98/54073 discloses an apparatus for a manual loading and unloading of aircrafts.

[0005] This known apparatus comprises a telescopic conveyor being moved into the cargo compartment and being provided at the end with a table adjustable in height, said table being placed inside the cargo compartment so as to allow a piling of the cargo items therefrom. A conveyor belt is arranged outside the aircraft, said conveyor belt advancing the cargo items to the telescopic conveyor part.

[0006] DK-PS No. 170863 discloses a conveyor with a plurality of linked units, where each unit on the upper face comprises a plurality of carrier rollers. These carrier

rollers are in turn carried by transverse shafts and are provided with wheels on the bottom side, said wheels allowing the units to roll on a base. A plurality of these linked units is pulled into the cargo compartment of the aircraft from a storing compartment below a belt conveyor arranged outside said aircraft.

Brief Description of the Invention

[0007] The object of the invention is to provide an apparatus which presents a relatively simple structure, and which allows a relatively easy advancing and removal of cargo items into and out of the cargo compartment of an aircraft while ensuring an easy and continuous movement of said cargo items.

[0008] This object is achieved by the apparatus described above being characterised in that

each of said conveyor units define a respective activatable conveyor path and in that said first end conveyor unit includes means for varying the inclination of said conveyor path of said first end conveyor unit,

whereby a mutual sideways pivotal movement of at least two successive conveyor units allow for sideways movement of said first end conveyor unit.

[0009] As a result it is relatively easy to handle the extendable second conveyor while simultaneously allowing an easy and continuous movement of the cargo items because the individual conveyor units roll on the floor of the cargo compartment towards and away from the loading site in question inside said cargo compartment and because said conveyor units are adapted to assist in the movement of said cargo items by means of their own driving means.

[0010] According to the invention the conveyor paths of the first and the second conveyors, respectively, may extend end to end, and the pivotally interconnected conveyor units may at least partially form part of the conveyor paths of both conveyor units because they continue directly into one another from the first to the second conveyor part during the extension and the retraction of the second conveyor part. The resulting total conveyor path of the apparatus is relatively uninterrupted and plane.

[0011] Preferably, the coupling members also allowing for a mutual pivotal movement of said conveyor units about an essentially horizontal axis.

[0012] According to an advantageous embodiment of the invention, the first conveyor part may comprise a continuous conveyor belt, where the conveyor path of said conveyor belt is adjustable in length in response to the extension or retraction of the conveyor units.

[0013] Furthermore, the apparatus according to the invention may comprise a bridge member, by means of which the conveyor units of the second conveyor part are transferred between the apparatus and the aircraft.

This bridge member ensures an even transition between the apparatus and the aircraft.

[0014] According to the invention it is particularly advantageous when the continuous conveyor belt of the first conveyor extends between a front turning member placeable adjacent the aircraft and a rearmost turning member, where said first conveyor in addition comprises an intermediate redirecting member reciprocating in the conveying direction and directing the conveyor belt from a rectilinear upper path between the rearmost turning member and the redirecting member to an intermediate path parallel to the upper path, but on a level below said upper path between the redirecting member and the front turning member, whereby the conveyor belt between the front turning member and the rearmost turning member extends below the upper and the intermediate paths, and whereby the upper path forms at least part of the conveyor path of the first conveyor, and whereby the rear end of the number of conveyor units is connected to the redirecting member of the first conveyor and accordingly adapted to follow the reciprocating movement thereof, said conveyor units being moved above the intermediate path of the first conveyor part while positioned outside the aircraft. As a result the conveyor paths of the first and the second conveyors, respectively, can in a simple manner continue substantially uninterruptedly into one another while it is simultaneously ensured that room is provided for the number of conveyor units or the rearmost portion thereof when all conveyor units or the rearmost portion thereof are not positioned inside the aircraft.

[0015] The apparatus may according to the invention advantageously comprise a supporting means supporting the endless conveyor belt of the first conveyor during its movement within the upper path.

[0016] According to the invention it is particularly advantageous when the conveyor paths of both conveyors are formed by means of the conveyor units across their entire length. Furthermore, the apparatus may according to the invention comprise a compartment for receiving the rearmost end of the number of conveyor units, said conveyor units in sequence being adapted to be moved out of or into said compartment in response to the distance which the front end must be moved into the aircraft. In this manner it is easy to adapt the number of conveyor units to the length of the cargo compartment of the aircraft in question.

[0017] Moreover, the first conveyor part may comprise an endless conveyor belt and be arranged above the path of the conveyor units to an area adjacent the bridge member with the result that it is possible to limit the number of conveyor units and consequently the associated compartment capacity of the apparatus.

[0018] The first end conveyor first end conveyor unit may according to the invention comprise a conveyor flap pivotally journaled at the back and which can be arranged with a desired inclination relative to the operating plane of the remaining conveyor units by means of driv-

ing means. As a result the operator can place the front end of the conveyor flap at a desired level opposite the stack of cargo items being handled at the specific time inside the aircraft.

[0019] In this connection the conveyor flap may according to the invention at the front end farthest away from the pivoting location be provided with a conveyor front member also being hingedly journaled, and which can be set with a desired inclination relative to the advancing plane of the conveyor flap by means of its own driving means. As a result the operator can place the front member in a plane suited for the most advantageous path in and out of a stack of the cargo item in question.

[0020] According to the invention each conveyor unit may comprise an endless conveyor belt driven by a driving roller and one or more additional rollers which are all carried by a frame, said frame in turn being supported by a wheel-carrying support member. The resulting conveyor unit is particularly simple.

[0021] The conveyor flap of the first end conveyor unit may according to the invention be formed by the frame and the associated conveyor belt and be pivotally journaled on the wheel-carrying support member, and the driving means thereof may be a plurality of electrically driven actuators. As a result, the front conveyor unit can in a simple manner be moved forwards and backwards inside a cargo compartment although the conveyor flap is arranged with an inclination relative to the floor of said cargo compartment.

[0022] Moreover, the conveyor flap may according to the invention project a distance beyond the associated support member when seen in the conveying direction of the second conveyor part during the loading, and according to the invention the conveyor flap may at its front end or the conveyor front member be provided with wheels for supporting said conveyor flap and said conveyor front member when they are in the flapped down position. As a result, an operator can easily find room below the conveyor flap for his legs when said conveyor flap is placed in an inclined position. However, when the conveyor front member is flapped down the wheels of said conveyor front member ensure that the flap is supported and can be easily handled together with the remaining conveyor units.

[0023] It is according to the invention particularly advantageous when the front end of the second conveyor is provided with a control means connected to all the driving means of the apparatus in such a manner that an operator present inside the aircraft can guide said means by activating said control means. As a result the operator has an efficient control of both conveyor parts.

[0024] The conveyor units may according to the invention be interconnected by means of releasable coupling means with the result that the conveyor units are easily replaced and it is possible, if desired, to adjust the number thereof to the prevailing requirements.

[0025] Furthermore, the bridge member may accord-

ing to the invention comprise guiding means for guiding the second conveyor part while it is moved inwards and outwards of the cargo compartment of the aircraft. The resulting movement can be performed in a relatively easy manner.

[0026] Moreover, at least some of the coupling means of the conveyor units may according to the invention be such that adjacent conveyor units can be mutually displaced transverse to the conveying direction with the result that they are very easily adjusted to the dimensions of the cargo compartment.

[0027] According to the invention it is particularly advantageous when the conveyor front member on the front conveyor unit comprises an endless conveyor belt with its own driving means.

[0028] Finally, the apparatus may according to the invention suitably be arranged on a vehicle.

Brief Description of the Drawings

[0029] The invention is explained in greater detail below with reference to the accompanying drawings, in which

Fig. 1 is a diagrammatic side view of a first embodiment of the apparatus according to the invention, whereby parts have been removed for the sake of clarity,

Fig. 2 is a side view of a first and a second conveyor part of Fig. 1, where the second conveyor part is arranged in the completely extended state,

Fig. 3 corresponds to Fig. 1, but where the second conveyor part is arranged in the partly extended state,

Fig. 4 corresponds to Fig. 2, but where the second conveyor part is completely retracted relative to the first conveyor part,

Fig. 5 is a top view of the embodiment of Fig. 4,

Fig. 6 is a top view on a larger scale of the embodiment of Fig. 5, but where parts have been removed for the sake of clarity,

Fig. 7 is a side view of the embodiment of Fig. 6,

Figs. 8 to 11 are diagrammatic top views of various steps of the apparatus during the moving of the second conveyor part into the cargo compartment of an aircraft,

Fig. 12 is a diagrammatic view of the apparatus with a bridge member extending through the opening into the cargo compartment of an aircraft, but where the conveyor parts have been removed for the sake

of clarity,

Figs. 13 and 14 are a top and a side view, respectively, of the various steps of the front end of the second conveyor part,

Fig. 15 is a diagrammatic, perspective view of a conveyor unit forming part of the second conveyor part, whereby parts have been shown separately for the sake of clarity,

Figs. 16 and 17 are diagrammatic views of the front end of the second conveyor part during the loading and the unloading, respectively,

Figs. 18 and 19 are diagrammatic views of a second embodiment of the apparatus according to the invention, where both the first and the second conveyor part are formed by a coherent row of conveyor units shown in the extended and the retracted state, respectively,

Fig. 20 illustrates an apparatus according to the invention with a tiltable bridge member,

Fig. 21 is a perspective view of a second embodiment of a conveyor unit forming part of the second conveyor part, where the individual parts have been separated for the sake of clarity,

Fig. 22 is a perspective view of a second embodiment of the front conveyor unit of the second conveyor part,

Fig. 23 is a perspective view of a second embodiment of a bridge member, and

Fig. 24 illustrates a third embodiment of the apparatus according to the invention, where the first conveyor part is formed by an endless conveyor belt arranged above the row of conveyor units of the first conveyor part within the path of said conveyor units from a storing compartment to the bridge member.

Best Mode for Carrying Out the Invention

[0030] The apparatus of Fig. 1 comprises a vehicle designated the general reference numeral 1 and provided with a cab 2 and a platform 3. The cab 2 is of a width corresponding to approximately half the width of the platform 3. Next to the cab 2, the vehicle 1 is provided with a ramp 4 tiltably arranged in a manner not described in greater detail. This ramp 4 can be positioned with a suitable inclination relative to the platform 3 of the vehicle 1 by means of an actuator 5. The ramp 4 extends substantially across the entire length of the vehicle 1, the front end 6 of said ramp being positioned in the area around the front side of the cab 2.

[0031] The ramp 4 carries a first conveyor part designated the general reference numeral 7, and a second conveyor part 7 designated the general reference numeral 8. The first conveyor part 7 comprises an endless conveyor belt 9 shown in detail in Figs. 1 to 4 where parts of the four sides of the ramp have been removed for the sake of clarity. At the rear end of the ramp 4, this endless conveyor belt 9 runs from a lower path 10 to an upper path 11 or vice versa through a rear turning member 12 which is provided with a plurality of rollers 13, 14 and 15. At its front end, the upper path 11 ends at a redirecting member designated the general reference numeral 16, cf. also Figs. 6 and 7. The redirecting member 16 comprises two interconnected rollers 17 and 18 redirecting the conveyor belt 9 to an intermediate path 19 continuing forwards towards the front end 6 of the ramp parallel to the upper path 11, but on a level therebelow. This intermediate path 19 ends at a front turning member designated the general reference numeral 20 and comprising a single roller 21. The conveyor belt 9 returns to the lower path 10 through the latter single roller 21, said lower path 10 extending parallel to the upper path 11 and the intermediate path 19.

[0032] As shown in particular in Figs. 6 and 7, the redirecting member 16 is by means of a U-shaped bracket 22 connected to the rear end of the second conveyor part 8 when seen in the longitudinal direction of the vehicle 1. As the bracket 22 simultaneously engages suitable guides not shown in greater detail along the sides 23 and 24 of the ramp 4, cf. Fig. 6, the reciprocating movement of the second conveyor part 8 relative to the longitudinal direction of the vehicle 1 implies that the redirecting member 16 follows said movement in such a manner that the upper conveyor path 11 of the first conveyor part 7 is of an increasing or decreasing length in response to the position of the rear end of the second conveyor part 8. Within the intermediate path 19, the conveyor belt 9 is supported by a supporting plate 25, cf. Fig. 7, through suitable means (not shown) for reducing the friction.

[0033] Within the upper path 11, the conveyor belt 9 is supported by a supporting means 26 comprising a high number of interconnected lamellas 27, said lamellas being hingedly interconnected along the longitudinal side farthest away from the conveyor belt 9. At one end, this supporting means 26 is connected to the redirecting member 16 in such a manner that it follows the movement of said redirecting member 16. In addition, the supporting means is adapted to move from a position immediately adjacent the lower path 10 to a position below the upper path 11 through the rear end adjacent the turning member 12 of said supporting plate 25 in such a manner that the number of lamellas in the supporting state below the upper path 11 corresponds substantially to the entire length of the upper path 11. If necessary, the movement from one side to the opposite side of the supporting plate can be facilitated by means of guides not shown in greater detail. In addition, the end of the

supporting means 26 farthest away from the redirecting member 16 can also be connected to said redirecting member through conventionally known means in such a manner that the end in question is subjected to a tractive force when the redirecting member 16 is moved downwards towards the rearmost turning member 12.

[0034] The second conveyor part 8 comprises a plurality of conveyor units 30, which all are substantially identical apart from the front conveyor unit 31. All the conveyor units 30 comprise a continuous belt 32, cf. Fig. 15, driven around suitable rollers 33, 34 and 35. These rollers are journaled in a frame 36 arranged on a support member 37.

[0035] The support member 37 is arranged on rollers 44. The conveyor units 30, 31 are interconnected by means of flexible coupling means which allow said conveyor units to be mutually turned both in horizontal and in vertical direction and be mutually displaced a short distance in the same directions. The coupling means are surrounded by bellow-shaped tubes of rectangular cross sections and with circumferential waves. The frames 36 and the support members 37 are made of a suitable plastic material. The coupling means are furthermore adapted in a manner not described in greater detail to releasably couple the conveyor units 30, 31 together in such a manner that said conveyor units are easily replaceable. In addition, the bellow-shaped tube surrounding the coupling means provides an easy access to passage of a main distributing system with associated coupling equipment with the result that the individual conveyor units 30, 31 can be supplied with the desired energy, such as electric current in an easy manner. As mentioned above, the rearmost conveyor unit 30 is connected to the redirecting member 16 of the first conveyor part. The conveyor units are further provided with such a height that the conveying plane thereof, i.e. the upper side of the conveyor belts 32, flushes with the upper path 11 of the endless conveyor belt 9, cf. Fig. 7.

[0036] The front conveyor unit 31 comprises a rearwardly journaled conveyor flap 39, cf. in particular Figs. 13 and 14. In Fig. 13, the conveyor flap 39 is shown in two possible positions and in Fig. 14 three possible positions are shown. This conveyor flap 39 comprises an endless conveyor belt 40 received in a manner not described in greater detail in a frame 41. At the back, the frame 41 is pivotally journaled in a manner not described in greater detail in a support member 42 also arranged on wheels 44, cf. Fig. 1. Jacks 43 are arranged between the frame 41 and the support member 42, said jacks allowing an adjustment of the conveyor flap 39 in a position with a desired inclination.

[0037] At the front, the conveyor flap 39 is provided with a pivotally journaled conveyor front member 45. When seen from the side, this conveyor front member 45 is of a triangular cross section and also associated with an endless conveyor belt 46. This conveyor front member 45 can be set with a desired inclination relative to the conveyor flap 39 by means of members not shown

in greater detail. The upper side of the conveyor belt 46 of the conveyor front member 45 is mainly positioned in a horizontal plane when the conveyor flap 39 is arranged with a predetermined inclination relative to the conveying direction of the remaining conveyor units.

[0038] The conveyor front member 45 comprises furthermore wheels 44 implying that said conveyor front member 45 can facilitate the support of the relatively far projecting conveyor flap 39 together with the support member 42.

[0039] Handles 47 and 48 are accommodated on the side of the frame 41 of the conveyor flap 39. These handles 47 and 48 allow an operator to manoeuvre the second conveyor part 8. These handles 47 and 48 are in addition adapted to be used as control means such a manner that by a suitable turning of said handles the operator can activate or actuate the various driving means not shown of the first and the second conveyor parts 7, 8.

[0040] An extendable bridge member 50 is mounted in connection with the front end of the ramp, cf. Figs. 8 to 12 and 20. This bridge member 50 is tiltable, cf. Fig. 20, and adapted to be arranged in a substantially horizontal position by means of an actuator 28 so as to be moved through an opening 51 into a cargo compartment 52 of an aircraft 53. In Figs. 8 to 12, the door usually closing the opening to a cargo compartment 52 has been removed. Then the bridge member forms a bridge between the ramp 4 and the floor 54 of the cargo compartment 52 directly inside the opening 51.

[0041] As illustrated in Fig. 8, the bridge member 50 is positioned directly below the front conveyor unit 31 when said conveyor unit is in the retracted state on the ramp. As illustrated in Fig. 9, the bridge member is moved forwards and through the opening 51 together with the front conveyor unit 31. This inward movement is carried out at the same time as the inclination of the ramp 4 is adjusted so as to mate the floor 54 of the cargo compartment 52. When the bridge member has been positioned so as to rest on the floor 54 inside the cargo compartment 52, the front conveyor unit is lifted outwards to one side or the opposite side of said bridge member 50 in such a manner that from this position it can be pulled backwards or pushed forwards inside said cargo compartment together with the subsequent conveyor units 30. Such a control or guiding of the front conveyor unit 31 and the succeeding conveyor units 30 is enhanced by a raised platform 55 with suitably shaped guiding sides 56 and 57, said conveyor units 30 and 31 sliding against said guiding sides during their movement. Suitable means not shown couple and uncouple the bridge member to and from the front conveyor unit 31 in such a manner that together with said conveyor unit 31 the bridge member can be moved into and out of the opening 51 of the cargo compartment 52.

[0042] During the use of the apparatus according to the invention, the second conveyor part is pushed and moved into the cargo compartment in question, cf. Figs.

10 and 11, where an operator can use said second conveyor part for the loading and unloading, respectively, cf. Figs. 16 and 17. As illustrated in Fig. 16, the operator can let the luggage 59 be pulled upwards over his legs by means of the conveyor flap 39 and subsequently by means of the conveyor front member 45 directly on top of, a stack 60 of cargo items. During the unloading, the cargo items are pulled out of the stack 60 and placed on the front conveyor unit 31 and subsequently moved further out of the cargo compartment. During the use of the apparatus, the operator can, of course, position and use the conveyor flap 39 as he wishes. All the movements and stops as well as the adjustment of the length of the second conveyor part 8 inside the cargo compartment in question can by means of the handles 47 be controlled by the operator according to the prevailing circumstances inside said cargo compartment.

[0043] Figs. 18 and 19 illustrate a second embodiment of the apparatus according to the invention. Here the conveyor paths of both the first and the second conveyor part 7 and 8 are formed by a coherent row of conveyor units 30 and 31. The rear end of this row of conveyor units is received in a compartment 65 below the platform 3 of the vehicle 1, and from this position it is moved through the rear end of the vehicle upwards onto the ramp as the front end of the row is moved into the cargo compartment 52 of the aircraft 53. This embodiment is particularly suited for use in connection with particularly long cargo compartments 52 requiring a relatively high number of conveyor units.

[0044] The individual members, and especially the conveyor units of the second conveyor part 8 are made mainly of plastic materials in response to the desired strength. Furthermore, additional conveyors 61 and 62 can be mounted at the rear end of the apparatus so as to facilitate the transition between the equipment for the advancing and removal of luggage and the rear end of the first conveyor part 7. All driving means are connected to power sources in the vehicle 1 in a manner not described in greater detail.

[0045] Fig. 21 illustrates a second embodiment of a conveyor unit with a continuous belt 71 supported by rollers 72 and 73, where the first roller 72 is a driving roller supplied with electric energy as indicated through a conduit 116. The rollers 72 and 73 are journaled in a frame 75 by means of brackets 74 and 75. The frame 75 is at both sides provided with a pair of wheels 76 which are protected by means of screens 77 and 78, respectively, in such a manner that they are uncovered both at the top and at the bottom whereby the conveyor units can roll on suitable guides both in a position in which the conveyor belt 71 faces upwards and in a position in which said conveyor belt faces downwards, cf. Fig. 24. Screens 79 and 80 are mounted on the frame 75 along the sides of the conveyor belt 71.

[0046] The conveyor units are joined by means of coupling members 81 and 82 preferably made of die-cast aluminium. These coupling members 81 and 82 are

pivotally journaled about axes 83 and 84 in two abutting conveyor units and mutually pivotally journaled about an axis 85, a rubber unit 86 being placed between said coupling members. This rubber unit 86 ensures both a straightening of the conveyor units when said conveyor units are not subjected to a mutually turning load, and provides a protected passage of electric conduits between the conveyor units through suitable channels 87 and 88. The conveyor units carry members 115 co-operating with the coupling members 81 and 82 in such a manner that they can only turn in one direction about the axes 83 and 84 away from a common plane through the conveyor units parallel to their conveyor paths.

[0047] Fig. 22 illustrates a second embodiment of the front conveyor unit. This conveyor unit is designated the general reference numeral 90 and comprises a conveyor flap 91. At the front, the conveyor flap 91 forms a bend in such a manner that the front conveyor unit comprises a front member 92 permanently connected to the remaining portion of the flap 91. The front conveyor unit 90 comprises an endless conveyor belt 93 extending over the front member through suitable rollers. In front of the continuous belt 93, a pair of loosely journaled rollers 94 and 95 are provided. The conveyor flap 91 comprises a frame 96, which at the back is pivotally journaled in a support member 97. This support member 97 carries jacks 98 and supporting means 99 and 100 which are hingedly mounted on the support member 97 and displaceably mounted on the frame 96. The support member 97 comprises wheels 101 rotatably arranged about shafts which extend perpendicular to the plane of the support member 97. In addition, one or more wheels 102, cf. Fig. 24, are provided below the front member 92 of the flap 91, said wheels being of the same type as the wheels 101.

[0048] Fig. 23 illustrates a telescoping bridge member 105 comprising guide means 106 and 107. These guide means 106 and 107 allow a guiding of the row of conveyor units in the desired direction into the cargo compartment of an aircraft. The front guide means 107 of the two guide means is arranged on a rotatable disc 108 which allows a setting of said guide means 107 in the desired direction. The guide means 106 and 107 are adapted to co-operate with suitable guide members not shown on the bottom side of the conveyor units.

[0049] Fig. 24 illustrates a third embodiment of the invention. Here the conveyor path of the first conveyor part 7 is formed by a first endless conveyor belt 110 mounted above the path of the conveyor units 70 between a compartment 111 and the bridge member 105. The first conveyor part 7 comprises furthermore a front conveying means with a second continuous belt 112, and which in front tapers in such a manner that the cargo items being handled pass in a relatively easy manner to and from the first endless conveyor belt of the first conveyor part 7. As indicated in Fig. 24, rails 113 are provided in the compartment 111, and the conveyor units 70 can run on said rails by means of the wheels 76 while

the endless conveyor belts face downwards. The moving of the conveyor units 70 to and from the compartment is carried out by means of a driving, endless conveyor belt 114 which co-operates with the bottom side of the conveyor units 70 in a suitable manner, such as by way of friction.

[0050] The invention has been described with reference to preferred embodiments. Many modifications can be carried out without thereby deviating from the scope of the invention. The first and the second conveyor parts 7 and 8 and the associated ramp 4 can for instance be mounted on another equipment than the vehicle. In this connection the vital factor is that an adjustment can be performed to the positioning of the opening into the cargo compartment in question.

[0051] The invention has been described to be used in connection with aircrafts, but it can, of course, also be used in other situations where similar circumstances apply.

[0052] Instead of lamellas 27, the supporting means 26 can also be provided with rollers, and the conveyor units 30, 31 can be adapted to slide in suitable guides on the sides of the ramp 4 instead of resting on their own wheels as long as they are positioned on said ramp 4.

Claims

1. A ground apparatus for loading and unloading an aircraft (53) with a cargo compartment (52), said apparatus comprising:

a height-adjustable and tiltable first conveyor (7) which is adapted to convey cargo between an area outside said cargo compartment (52) and a second conveyor (8),

said second conveyor (8) having a first end and a second end and being at least partially extendable from said apparatus into said cargo compartment (52), said second conveyor (8) including a succession of conveyor units (30, 31, 70, 90) of which a first end conveyor unit (31, 90) is arranged at said first end,

wherein each conveyor unit (30, 31, 70, 90) has a set of wheels (44, 76, 101, 102) and wherein the conveyor units (30, 31, 70, 90) are mutually interconnected by means of coupling members (38, 81, 82) that allow for a sideways mutual pivotal movement of said conveyor units (30, 31, 70, 90),

characterised in that

each of said conveyor units (30, 31, 70, 90) define a respective activatable conveyor path and in that said first end conveyor unit (31, 90) includes means for varying the inclination of said conveyor path of said first end conveyor unit (31, 90), whereby a mutual sideways pivotal movement of at

least two successive conveyor units (30, 31, 70, 90) allow for a sideways movement of said first end conveyor unit.

2. An apparatus according to the preceding claim, said coupling members (38, 81, 82) also allowing for a mutual pivotal movement of said conveyor units (30, 31, 70, 90) about an essentially horizontal axis (83, 84).
3. Apparatus as claimed in claim 1, **characterised in that** the first conveyor (7) comprises a single endless conveyor belt (9) with an upper path (11) that defines a cargo-engaging surface.
4. An apparatus according to the preceding claim, wherein the length of the upper path (11) of said conveyor belt (9) is adjustable in response to the extension or retraction of said second conveyor (8).
5. An apparatus according to the preceding claim, **characterised in that** the endless conveyor belt (9) extends between a front turning member (20) placeable adjacent the aircraft (53) and a rearmost turning member (12), where said first conveyor (7) in addition comprises an intermediate redirecting member (16) reciprocating in the conveying direction and directing the conveyor belt (9) from a rectilinear upper path (11) between the rearmost turning member (12) and the redirecting member (16) to an intermediate path (19), parallel to the upper path (11), but on a level below said upper path between the redirecting member (16) and the front turning member (20), whereby the conveyor belt (9) between the front turning member (20) and the rearmost turning member (12) extends below said upper (11) and said intermediate path (19), and whereby the upper path (11) forms at least part of the conveyor path of the first conveyor (7), and that the second end of said succession of conveyor units (30, 31, 70, 90) is connected to the redirecting member (16) of the first conveyor (7) and accordingly adapted to follow the reciprocating movement thereof, said conveyor units (30, 31, 70, 90) being moved above the intermediate path (19) of the first conveyor (7) while positioned outside the aircraft (53).
6. An apparatus as claimed in claim 5, **characterised in** supporting means (26) for supporting the endless conveyor belt (9) of the first conveyor (7) during its movement within the upper path (11).
7. An apparatus according to any of the preceding claims, **characterised in that** the apparatus comprises a bridge member (50, 105) adapted to be supported by said aircraft and to support said conveyor units (30, 31, 70, 90) of the second conveyor (8) during the extension thereof from said apparatus in-

to the cargo compartment (52).

8. An apparatus according to any of the preceding claims 1 or 2, **characterised in that** the first conveyor (7) comprises a plurality of interconnected conveyor units (30, 31, 70, 90) each having a set of wheels (44, 76, 101, 102) and being pivotally interconnected by means of respective coupling means.
9. An apparatus according to any of the preceding claims, **characterised in that** the apparatus comprises a compartment (65, 111) for receiving said second conveyor.
10. An apparatus according to the preceding claim, **characterised in that** said first conveyor (7) is arranged above said compartment (52).
11. An apparatus according to any of claims 2-9, said apparatus having storage means (65, 111) for storing said second conveyor (8) in a state wherein at least two successive conveyor units are mutually pivoted about said essentially horizontal axis (83, 84).
12. An apparatus according to any of the preceding claims, **characterised in a** conveyor front member (45) which is hingedly mounted to said first end conveyor unit and which can be set with a desired inclination relative to the conveyor path of the first end conveyor unit (39).
13. Apparatus according to any of the preceding claims, **characterised in that** each conveyor unit (30, 31, 70, 90) comprises an endless conveyor belt (40, 46, 71, 93).
14. Apparatus according to the preceding claim wherein each endless conveyor belt is driven by a driving roller (72) and one or more further rollers (33, 34, 35, 73), which are supported by a frame (36, 41, 75), which in turn is supported by a wheel-carrying support member (37, 42, 77, 78, 97).
15. An apparatus according to claim 13 or 14, wherein the width of the conveyor belt (40, 46, 71, 93) is greater than the distance between said rollers.
16. An apparatus according to any of the preceding claims, **characterised in** control means (47, 48) whereby an operator present inside the aircraft (53) can control said second conveyor (8).
17. An apparatus according to any of claims 7-16 wherein the bridge member (50, 105) comprises guiding means (55, 56, 57, 106, 107) for guiding the second conveyor (8).

18. An apparatus according to any of the preceding claims wherein the first end conveyor unit (31, 90) comprises an endless conveyor belt (46).
19. An apparatus according to any of the preceding claims, **characterised in** driving means cooperating with said second conveyor for extending said second conveyor (8) from said apparatus, such as by way of friction.
20. An apparatus according to any of the preceding claims, **characterised in that** it is placed on a vehicle (1).

Patentansprüche

1. Bodengerät zum Laden und Entladen eines Luftfahrzeugs (53) mit einem Frachtabteil (52), wobei das Gerät umfasst:

einen höhenstellbaren und kippbaren ersten Förderer (7) der angepasst ist, Fracht zwischen einem Bereich außerhalb des Frachtabteils (52) und einem zweiten Förderer (8) zu befördern,

wobei der zweite Förderer ein erstes Ende und ein zweites Ende aufweist, und zumindest teilweise von dem Gerät in das Frachtabteil (52) ausfahrbar ist, und der zweite Förderer (8) eine Folge von Fördereinheiten (30, 31, 70, 90) hat, von denen eine erste Endfördereinheit (31, 90) an dessen erstem Ende angeordnet ist,

wobei jede Fördereinheit (30, 31, 70, 90) einen Satz Räder (44, 76, 101, 102) aufweist, und wobei die Fördereinheiten (30, 31, 70, 90) abwechselnd mittels Kopplungsteilen (38, 81, 82) zwischenverbunden sind, die eine seitliche, wechselweise Kippbewegung der Fördereinheiten (30, 31, 70, 90) gestatten, **dadurch gekennzeichnet, dass** jede Fördereinheit (30, 31, 70, 90) einen entsprechend aktivierbaren Förderweg definiert, und dadurch, dass die erste Endfördereinheit (31, 90) eine Einrichtung zum Variieren der Neigung des Förderwegs des ersten Endes der Fördereinheit (31, 90) hat, wobei eine gegenseitige seitwärtige Kippbewegung von zumindest zwei aufeinanderfolgenden Fördereinheiten (30, 31, 70, 90) eine Seitwärtsbewegung der ersten Endfördereinheit gestattet.

2. Gerät nach dem vorangehenden Anspruch, wobei die Kopplungsteile (38, 81, 82) ebenfalls eine gegenseitige Kippbewegung der Fördereinheiten (30, 31, 70, 90) um eine im Wesentlichen horizontale Achse (83, 84) gestatten.

3. Gerät nach Anspruch 1, **dadurch gekennzeichnet, dass** der erste Förderer (7) einen einzelnen, endlosen Fördergurt (9) mit einem oberen, eine Frachteingreiffläche definierenden Weg (11) umfasst.

4. Gerät nach dem vorangehenden Anspruch, wobei die Länge des oberen Wegs (11) des Fördergurts (9) in Erwiderung auf das Ausfahren und Zurückziehen des zweiten Förderers (8) einstellbar ist.

5. Gerät nach dem vorangehenden Anspruch, **dadurch gekennzeichnet, dass** der endlose Fördergurt (9) sich zwischen einem vorderen Drehteil (20), das angrenzend an das Luftfahrzeug (53) anordenbar ist, und einem rückwärtigsten Drehteil (12) erstreckt, wo der erste Förderer (7) zusätzlich ein mittleres Umlenkteil (16) aufweist, das sich in der Förderrichtung hin und her bewegt, und den Fördergurt (9) von einem geradlinigen oberen Weg (11) zwischen dem rückwärtigsten Umkehrteil (12) und dem Umlenkteil (16) zu einem Zwischenweg (19) umlenkt, der parallel zu dem oberen Weg (11) ist, aber auf einer Höhe unter dem oberen Weg zwischen dem Umlenkteil (16) und dem vorderen Drehteil (20),

wobei der Fördergurt (9) sich zwischen dem vorderen Drehteil (20) und dem rückwärtigsten Drehteil (12) unter dem oberen (11) und dem mittleren Weg (19) erstreckt, und wobei der obere Weg (11) zumindest einen Teil des Förderwegs des ersten Förderers (7) ausbildet, und dass das zweite Ende der Folge der Fördereinheiten (30, 31, 70, 90) mit dem Umlenkteil (16) des ersten Förderers (7) verbunden und entsprechend angepasst ist, dessen hin und her bewogender Bewegung zu folgen, wobei die Fördereinheiten (30, 31, 70, 90) oberhalb von dem mittleren Weg (19) des ersten Förderers (7) bewegt werden, während sie außerhalb des Luftfahrzeuges (53) positioniert sind.

6. Gerät nach Anspruch 5, **gekennzeichnet durch** eine Stützeinrichtung (26) zum Stützen des endlosen Fördergurts (9) des ersten Förderers (7) während dessen Bewegung innerhalb des oberen Wegs (11).

7. Gerät nach jedem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** das Gerät ein Brückenteil (50, 105) umfasst, das angepasst ist, durch das Luftfahrzeug gestützt zu sein, und die Fördereinheiten (30, 31, 70, 90) des zweiten Förderers (8) während des Ausfahrens des Geräts in das Frachtabteil (52) zu stützen.

8. Gerät nach jedem der vorangehenden Ansprüche 1 oder 2, **dadurch gekennzeichnet, dass** der erste Förderer (7) eine Vielzahl von zwischenverbundenen Fördereinheiten (30, 31, 70, 90) umfasst, wobei

jede einen Satz Räder (44, 76, 101, 102) aufweist, und kippbar mittels entsprechender Kopplungseinrichtungen zwischenverbunden ist.

9. Gerät nach jedem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** das Gerät ein Abteil (65, 111) zum Aufnehmen des zweiten Förderers umfasst. 5
10. Gerät nach dem vorangehenden Anspruch, **dadurch gekennzeichnet, dass** der erste Förderer (7) oberhalb von dem Abteil (52) angeordnet ist. 10
11. Gerät nach jedem der Ansprüche von 2 bis 9, wobei das Gerät eine Lagereinrichtung (65, 111) zum Lagern des zweiten Förderers (8) in einem Zustand hat, worin zumindest zwei nachfolgende Fördereinheiten gegenseitig um die im Wesentlichen horizontale Achse (83, 84) gekippt sind. 15 20
12. Gerät nach jedem der vorangehenden Ansprüche, **gekennzeichnet durch** ein vorderes Förderteil (45) das drehbar an der ersten Endfördereinheit befestigt ist, und das innerhalb einer gewünschten Neigung relativ zu dem Förderweg der ersten Endfördereinheit (39) eingestellt werden kann. 25
13. Gerät nach jedem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** jede Fördereinheit (30, 31, 70, 90) einen endlosen Fördergurt (40, 46, 71, 93) umfasst. 30
14. Gerät nach dem vorangehenden Anspruch, wobei jeder endlose Fördergurt durch eine Antriebsrolle (72) angetrieben wird, und eine oder weitere Rollen (33, 34, 35, 73) durch einen Rahmen (36, 41, 75) gestützt sind, der im Gegenzug durch ein Rad tragendes Stützteil (37, 42, 77, 78, 97) gestützt ist. 35
15. Gerät nach Anspruch 13 oder 14, wobei die Breite des Fördergurts (40, 46, 71, 93) größer als der Abstand zwischen den Rollen ist. 40
16. Gerät nach jedem der vorangehenden Ansprüche, **gekennzeichnet durch** eine Steuereinrichtung (47, 48), wobei ein innerhalb des Luftfahrzeuges (53) befindlicher Bediener den zweiten Förderer (8) steuern kann. 45
17. Gerät nach jedem der Ansprüche von 7 bis 16, wobei das Brückenteil (50, 105) eine Führungseinrichtung (55, 56, 57, 106, 107) zum Führen des zweiten Förderers (8) umfasst. 50
18. Gerät nach jedem der vorangehenden Ansprüche, wobei die erste Endfördereinheit (31, 90) einen endlosen Fördergurt (46) umfasst. 55

19. Gerät nach jedem der vorangehenden Ansprüche, **gekennzeichnet durch** eine Antriebseinrichtung, die mit dem zweiten Förderer zusammenarbeitet, um den zweiten Förderer (8) von dem Gerät auszufahren, wie zum Beispiel **durch** Reibung.

20. Gerät nach jedem der vorangehenden Ansprüche, **dadurch gekennzeichnet, dass** es auf einem Fahrzeug (1) angeordnet ist.

Revendications

1. Appareil au sol pour le chargement et le déchargement d'un aéronef (53) comportant une soute (52), ledit appareil comprenant :

un premier transporteur (7) inclinable et réglable en hauteur qui est destiné à transporter des marchandises entre une zone se trouvant à l'extérieur de ladite soute (52) et un deuxième transporteur (8),
ledit deuxième transporteur (8) présentant une première extrémité et une deuxième extrémité et étant apte à s'étendre au moins partiellement dudit appareil dans ladite soute (52), ledit deuxième transporteur (8) incluant une succession d'unités de transport (30, 31, 70, 90) dont une première unité de transport d'extrémité (31, 90) est prévue au niveau de ladite première extrémité,
chaque unité de transport (30, 31, 70, 90) comportant un ensemble de roues (44, 76, 101, 102) et les unités de transport (30, 31, 70, 90) étant raccordées entre elles au moyen d'éléments de couplage (38, 81, 82) qui permettent un mouvement de pivotement mutuel latéral desdites unités de transport (30, 31, 70, 90),

caractérisé en ce que

chacune desdites unités de transport (30, 31, 70, 90) définit un chemin de transport activable respectif et

ladite première unité de transport d'extrémité (31, 90) inclut des moyens destinés à faire varier l'inclinaison dudit chemin de transport de ladite première unité de transport d'extrémité (31, 90),

un mouvement de pivotement latéral mutuel d'au moins deux unités de transport successives (30, 31, 70, 90) permettant un mouvement latéral de ladite première unité de transport.

2. Appareil selon la revendication précédente, dans lequel lesdits éléments de couplage (38, 81, 82) permettent également un mouvement de pivotement mutuel desdites unités de transport (30, 31, 70, 90) autour d'un axe sensiblement horizontal (83, 84).

3. Appareil selon la revendication 1, **caractérisé en ce que** la premier transporteur (7) comporte une seule bande transporteuse sans fin (9) comprenant un chemin supérieur (11) qui définit une surface d'engagement avec des marchandises. 5
4. Appareil selon la revendication précédente, dans lequel la longueur du chemin supérieur (11) de ladite bande transporteuse (9) est réglable en fonction de l'extension ou de la rétraction dudit deuxième transporteur (8). 10
5. Appareil selon la revendication précédente, **caractérisé en ce que** la bande transporteuse (9) s'étend entre un élément de renvoi avant (20) pouvant être placé du côté de l'aéronef (53) et un élément de renvoi arrière (12), ledit premier transporteur (7) comprenant en plus un élément intermédiaire de changement de direction (16) effectuant un mouvement alternatif dans la direction de transport et dirigeant la bande transporteuse (9) d'un chemin supérieur rectiligne (11), entre l'élément de renvoi arrière (12) et l'élément de changement de direction (16), vers un chemin intermédiaire (19) parallèle au chemin supérieur (11), mais à un niveau au-dessous dudit chemin supérieur entre l'élément de changement de direction (16) et l'élément de renvoi avant (20), de sorte que la bande transporteuse (9) entre l'élément de renvoi avant (20) et l'élément de renvoi arrière (12) s'étend au-dessous du chemin supérieur (11) et du chemin intermédiaire (19), et de sorte que le chemin supérieur (11) forme au moins une partie du chemin de transport du premier transporteur (7), et que la deuxième extrémité de ladite succession d'unités de transport (30, 31, 70, 90) est reliée à l'élément de changement de direction (16) du premier transporteur (7) et est en conséquence prévue pour suivre le mouvement alternatif de celui-ci, lesdites unités de transport (30, 31, 70, 90) étant déplacées au-dessus du chemin intermédiaire (19) du premier transporteur (7) tout en étant positionnées à l'extérieur de l'aéronef. 20 25 30 35 40
6. Appareil selon la revendication 5, **caractérisé par** des moyens de support (26) destinés à supporter la bande transporteuse sans fin (9) du premier transporteur (7) pendant son mouvement à l'intérieur du chemin supérieur (11). 45
7. Appareil selon l'une quelconque des revendications précédentes 1 ou 2, **caractérisé en ce que** l'appareil comprend un élément de pontage (50, 105) prévu pour être supporté par ledit aéronef et pour supporter lesdites unités de transport (30, 31, 70, 90) du deuxième transporteur (8) pendant son extension dudit appareil dans la soute (52). 50 55
8. Appareil selon l'une quelconque des revendications précédentes, **caractérisé en ce que** le premier transporteur (7) comprend une pluralité d'unités de transport (30, 31, 70, 90) qui sont reliées entre elles, qui comportent chacune un jeu de roues (44, 76, 101, 102) et qui sont reliées à pivotement à l'aide de moyens de couplage respectifs.
9. Appareil selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'appareil comprend un compartiment (65, 111) destiné à recevoir ledit deuxième transporteur.
10. Appareil selon la revendication précédente, **caractérisé en ce que** ledit premier transporteur (7) est prévu au-dessus de ladite soute (52).
11. Appareil selon l'une quelconque des revendications 2 à 9, ledit appareil comportant des moyens de stockage (65, 111) destinés à stocker ledit deuxième transporteur (8) dans un état dans lequel au moins deux unités de transport successives sont pivotées l'une par rapport à l'autre autour dudit axe (83, 84) sensiblement horizontal.
12. Appareil selon l'une quelconque des revendications précédentes, **caractérisé par** un élément de transport avant (45) qui est monté de façon articulée sur ladite première unité de transport d'extrémité et qui peut être réglé avec une inclinaison souhaitée par rapport au chemin de transport de ladite première unité de transport d'extrémité (39).
13. Appareil selon l'une quelconque des revendications précédentes, **caractérisé en ce que** chaque unité de transport (30, 31, 70, 90) comprend une bande transporteuse sans fin (40, 46, 71, 93).
14. Appareil selon la revendication précédente, dans lequel chaque bande transporteuse sans fin est entraînée par un rouleau d'entraînement (72) et un ou plusieurs autres rouleaux (33, 34, 35, 73), qui sont supportés par un cadre (36, 41, 75), qui est supporté à son tour par un élément de support (37, 42, 77, 78, 97) monté sur roues.
15. Appareil selon la revendication 13 ou 14, dans lequel la largeur de la bande transporteuse (40, 46, 71, 93) est supérieure à la distance entre lesdits rouleaux.
16. Appareil selon l'une quelconque des revendications précédentes, **caractérisé par** des moyens de commande (47, 48) permettant à un opérateur, présent à l'intérieur de l'aéronef (53), de commander ledit deuxième transporteur (8).
17. Appareil selon l'une quelconque des revendications 7 à 16, dans lequel l'élément de pontage (50, 105)

comprend des moyens de guidage (55, 56, 57, 106, 107) destinés à guider le deuxième transporteur (8).

18. Appareil selon l'une quelconque des revendications précédentes, dans lequel la première unité de transport d'extrémité (31, 90) comprend une bande transporteuse sans fin (46). 5

19. Appareil selon l'une quelconque des revendications précédentes, **caractérisé par** des moyens d'entraînement coopérant avec ledit deuxième transporteur dans le but d'étendre ledit deuxième transporteur (8) depuis ledit appareil, par exemple par friction. 10

20. Appareil selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'il** est placé sur un véhicule (1). 15

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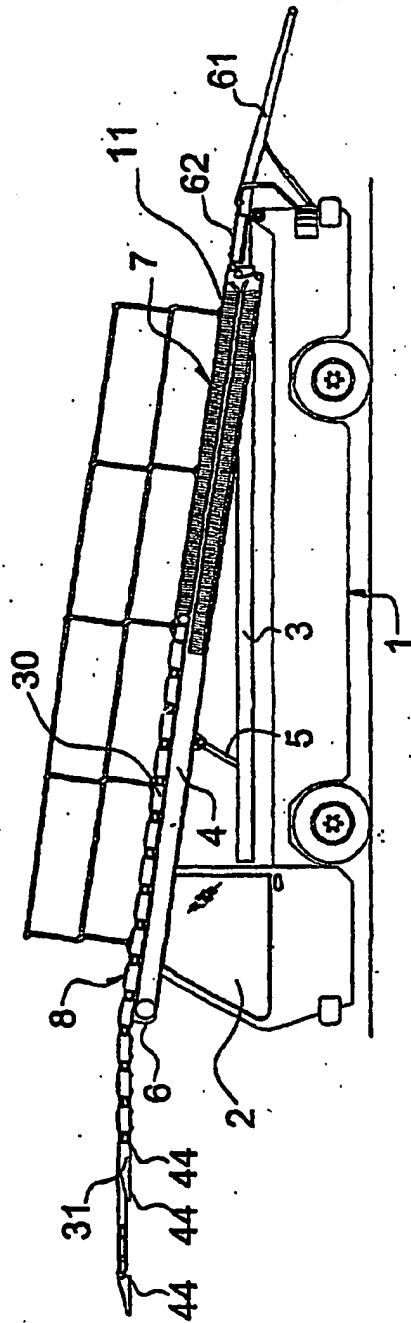


Fig 1

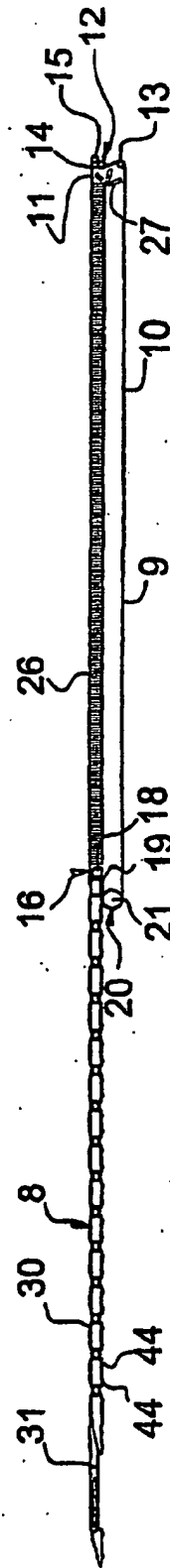


Fig 2

Fig 3

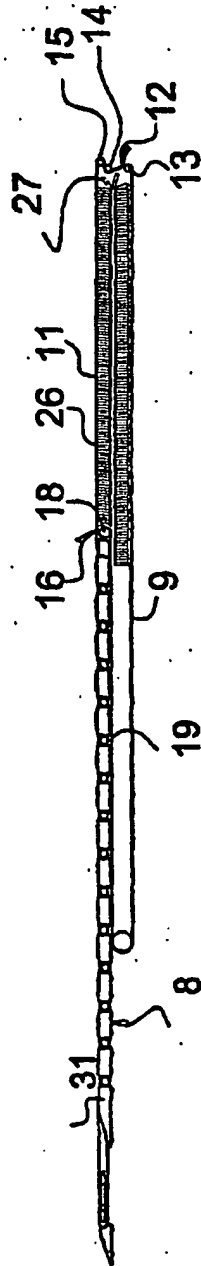


Fig 4

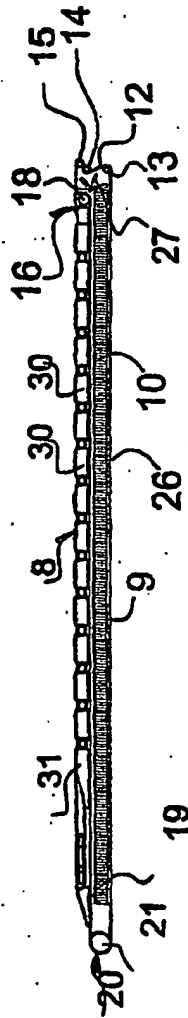
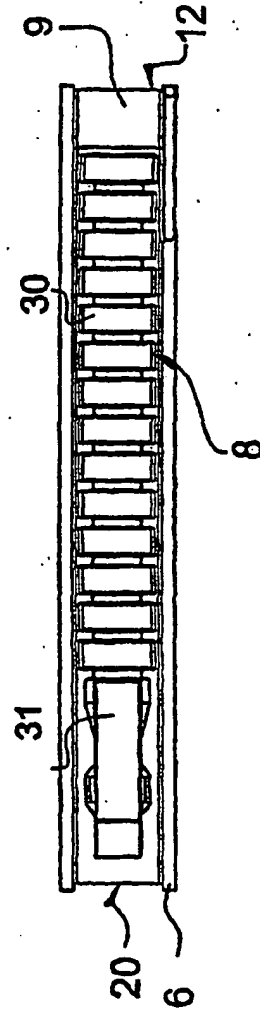


Fig 5



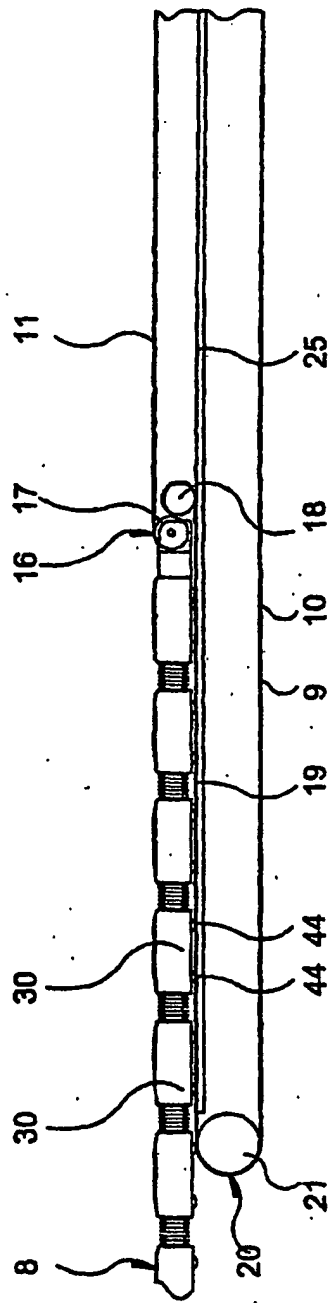


Fig 7

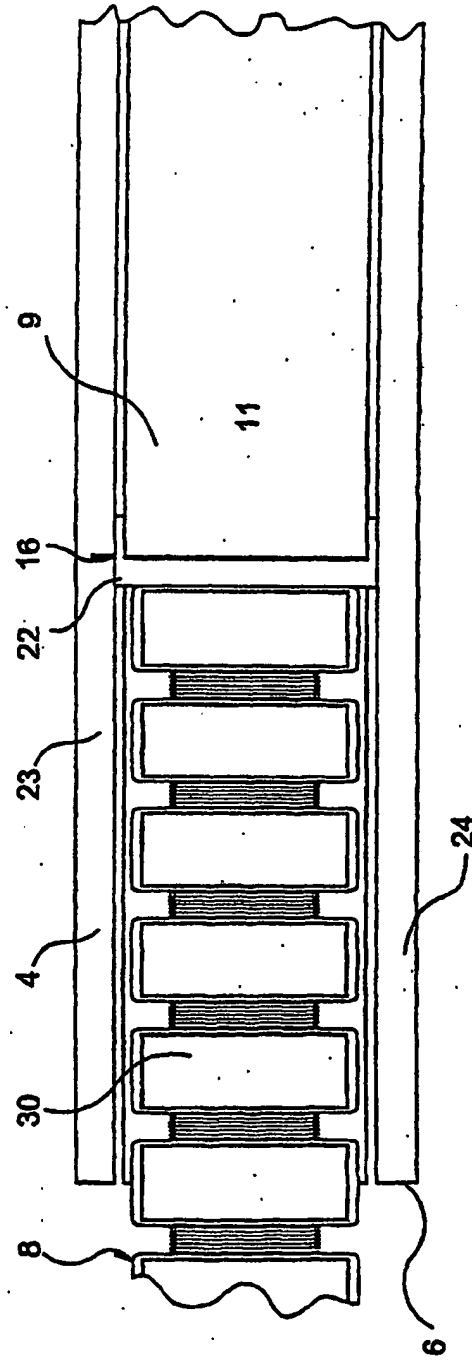


Fig 6

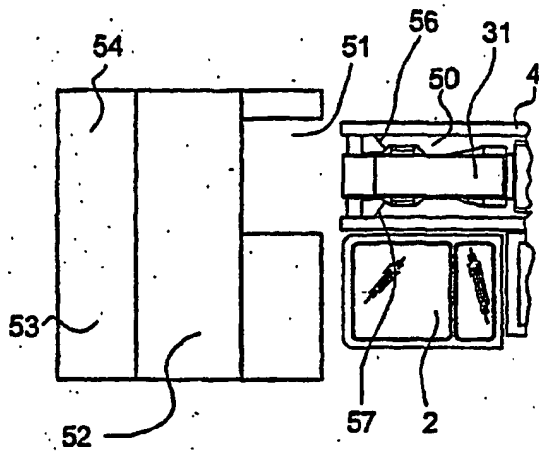


Fig 8

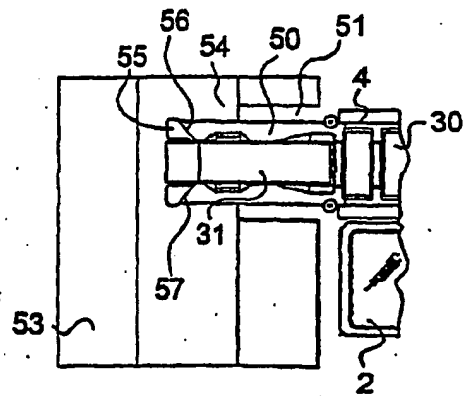


Fig 9

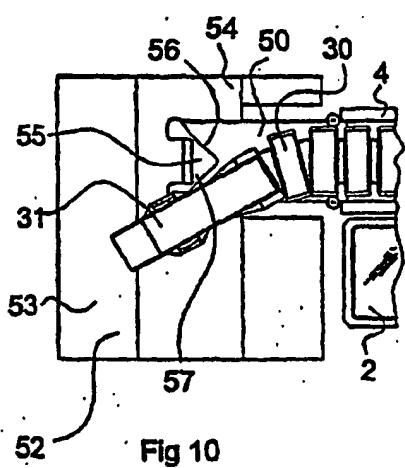


Fig 10

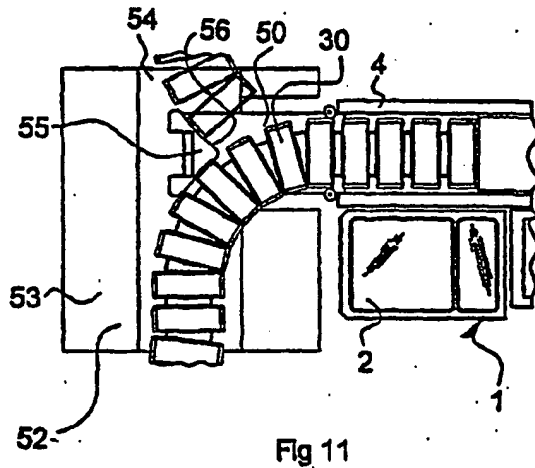


Fig 11

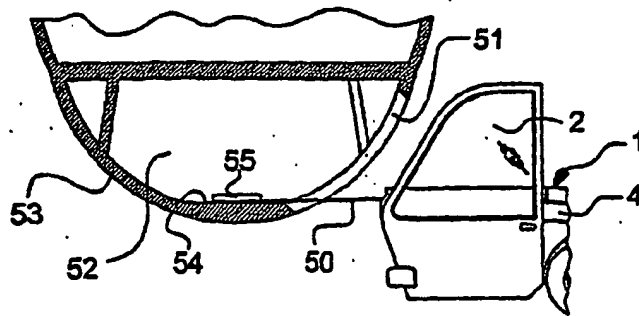


Fig 12

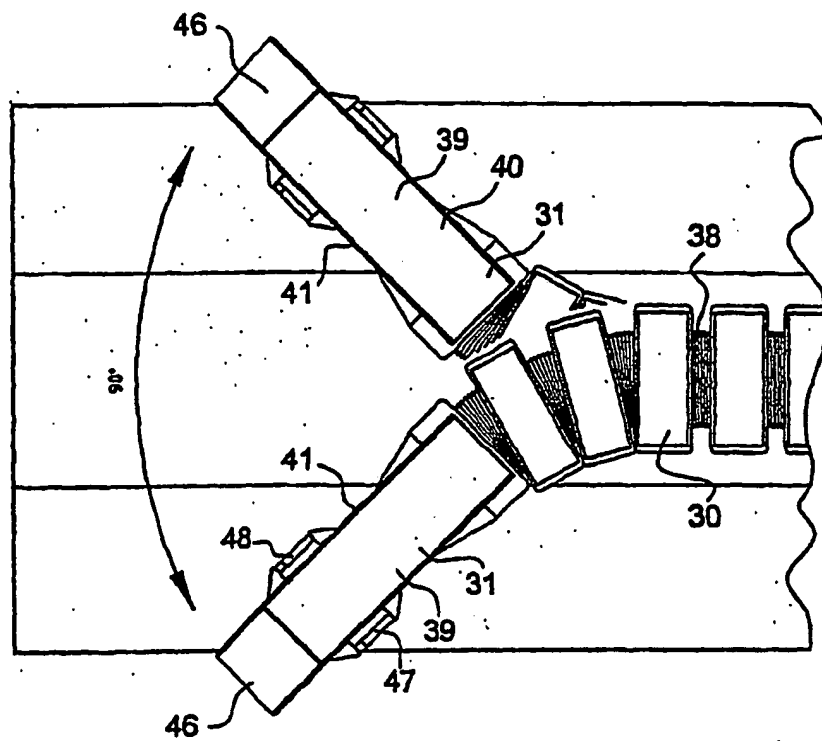


Fig 13

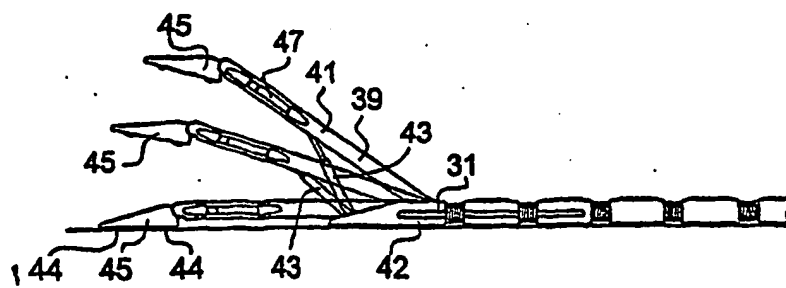
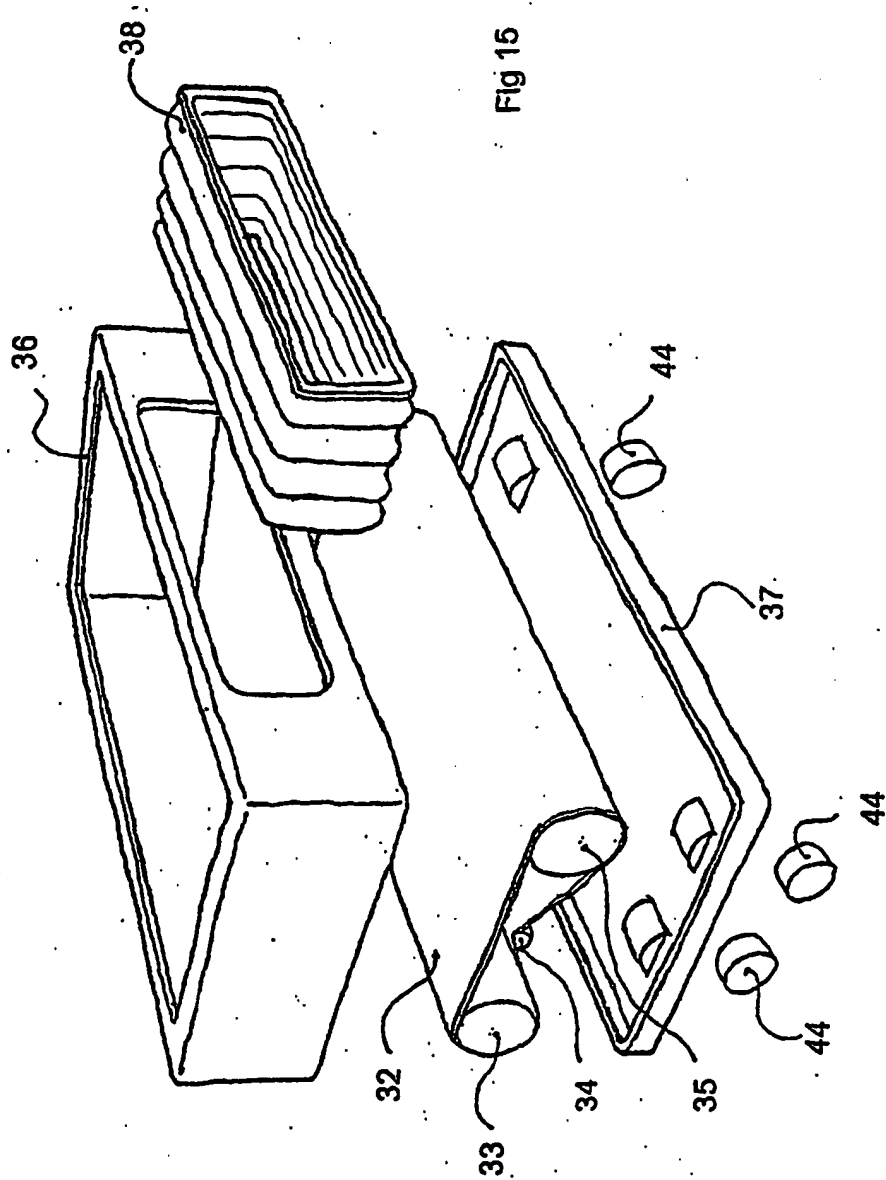
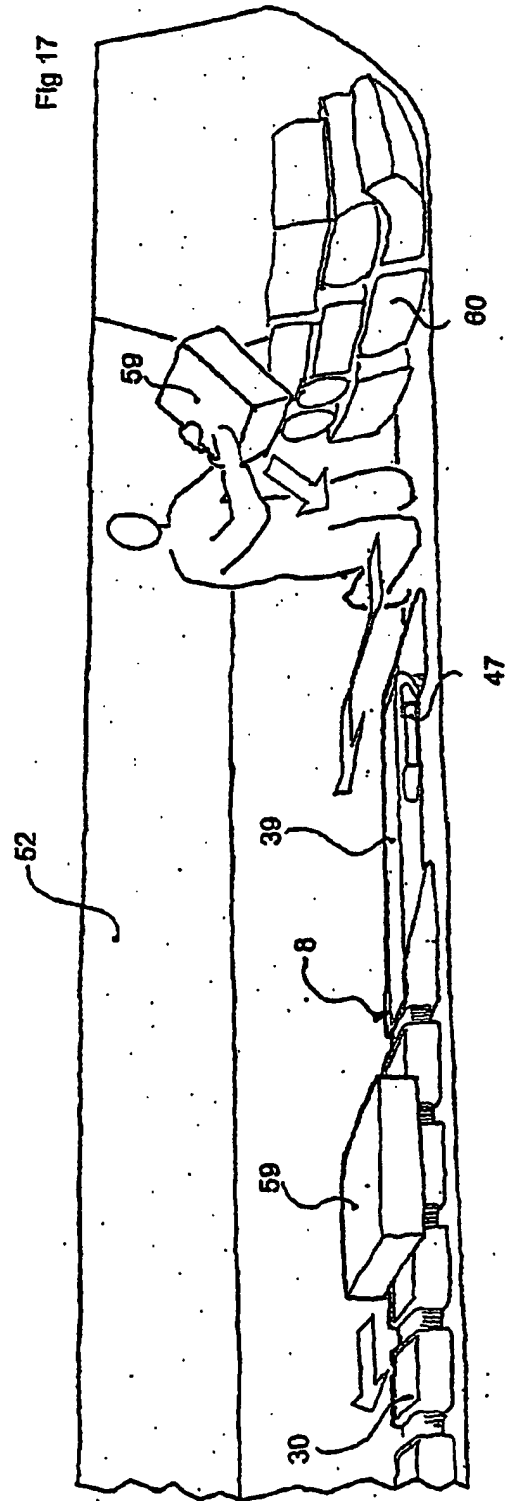
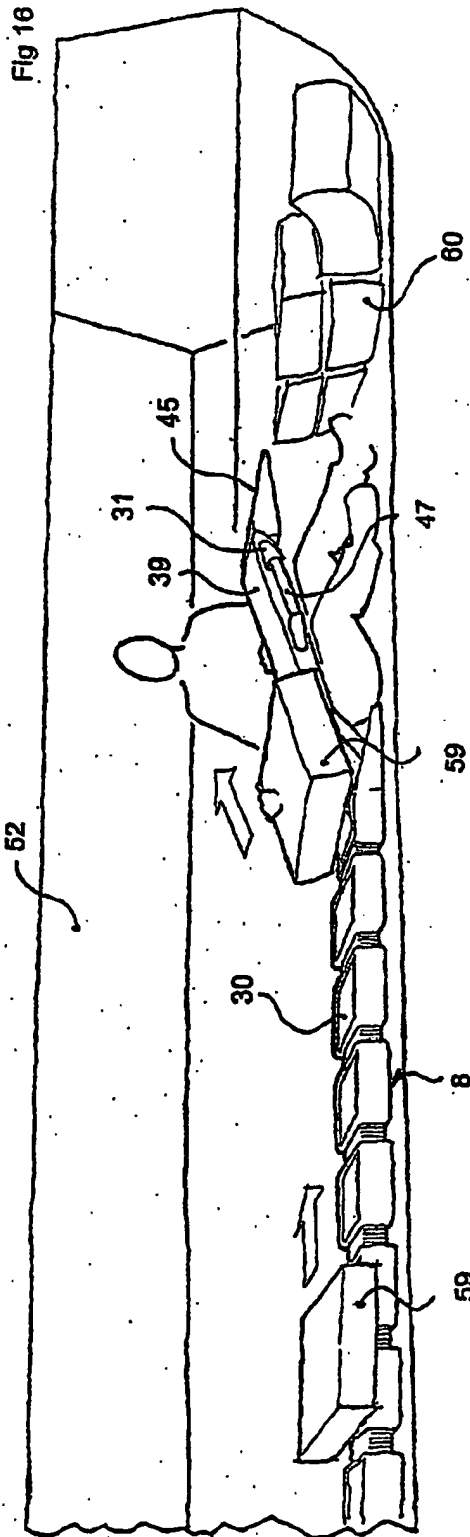


Fig 14





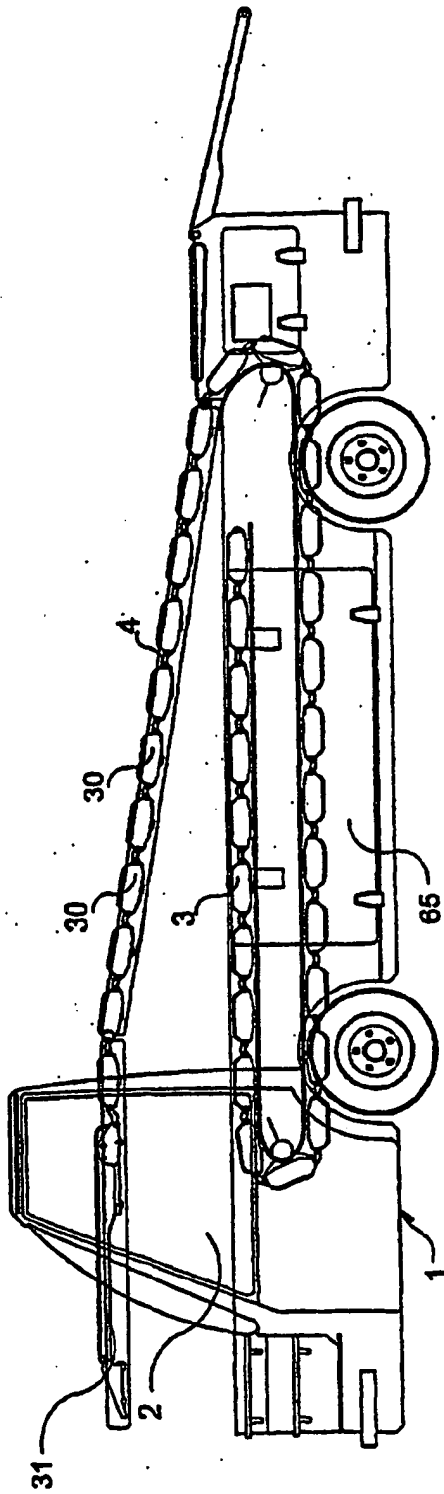


Fig 18

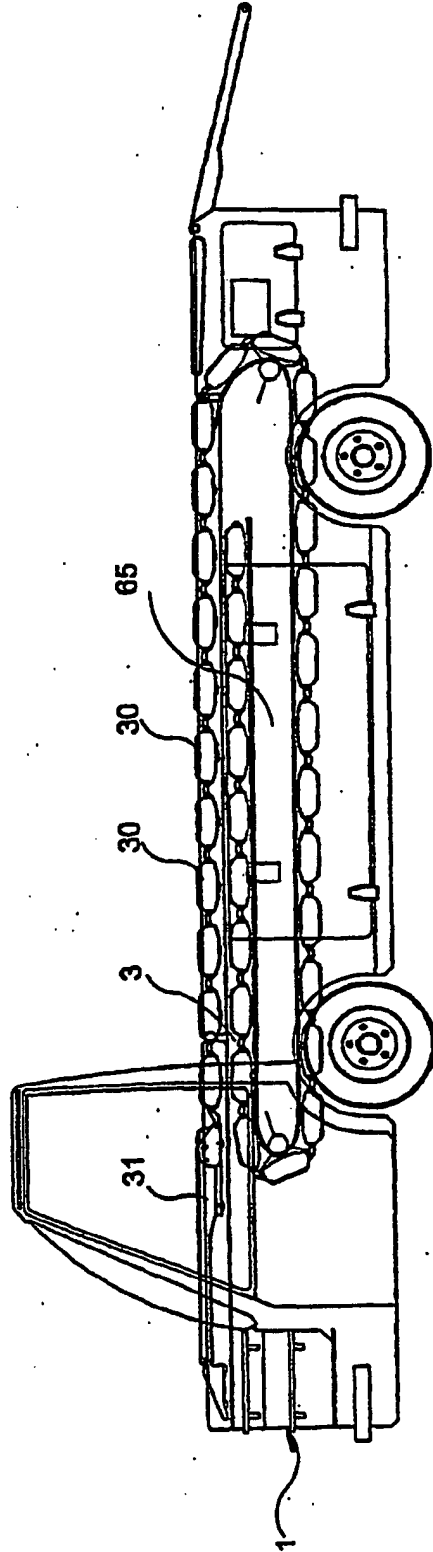


Fig 19

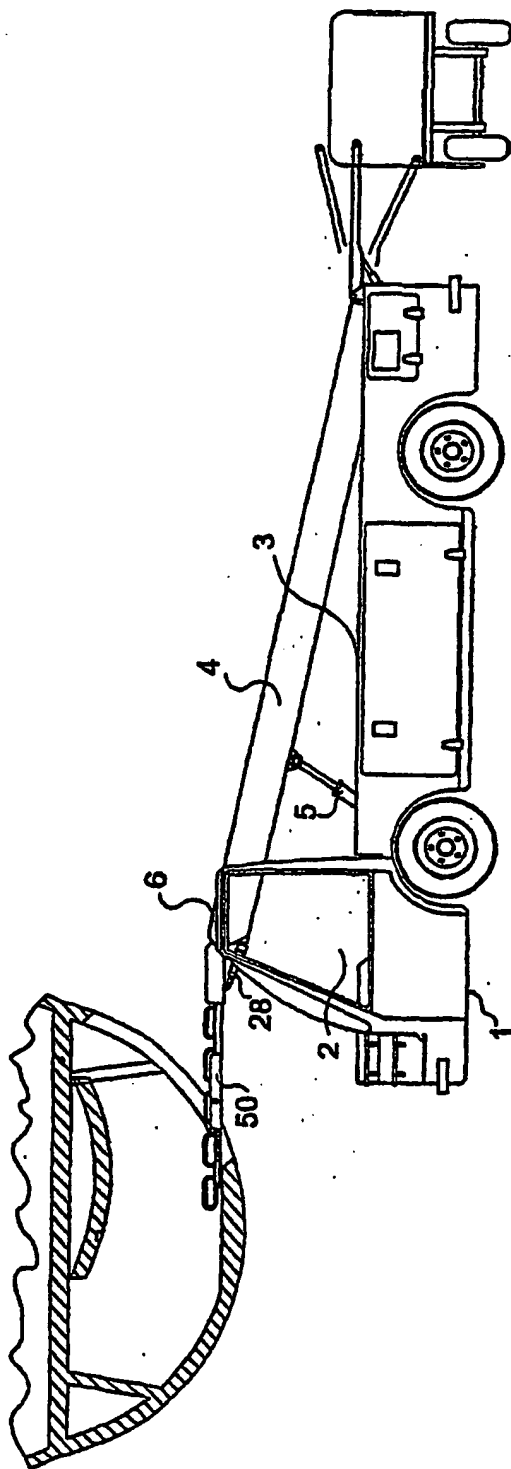


Fig 20

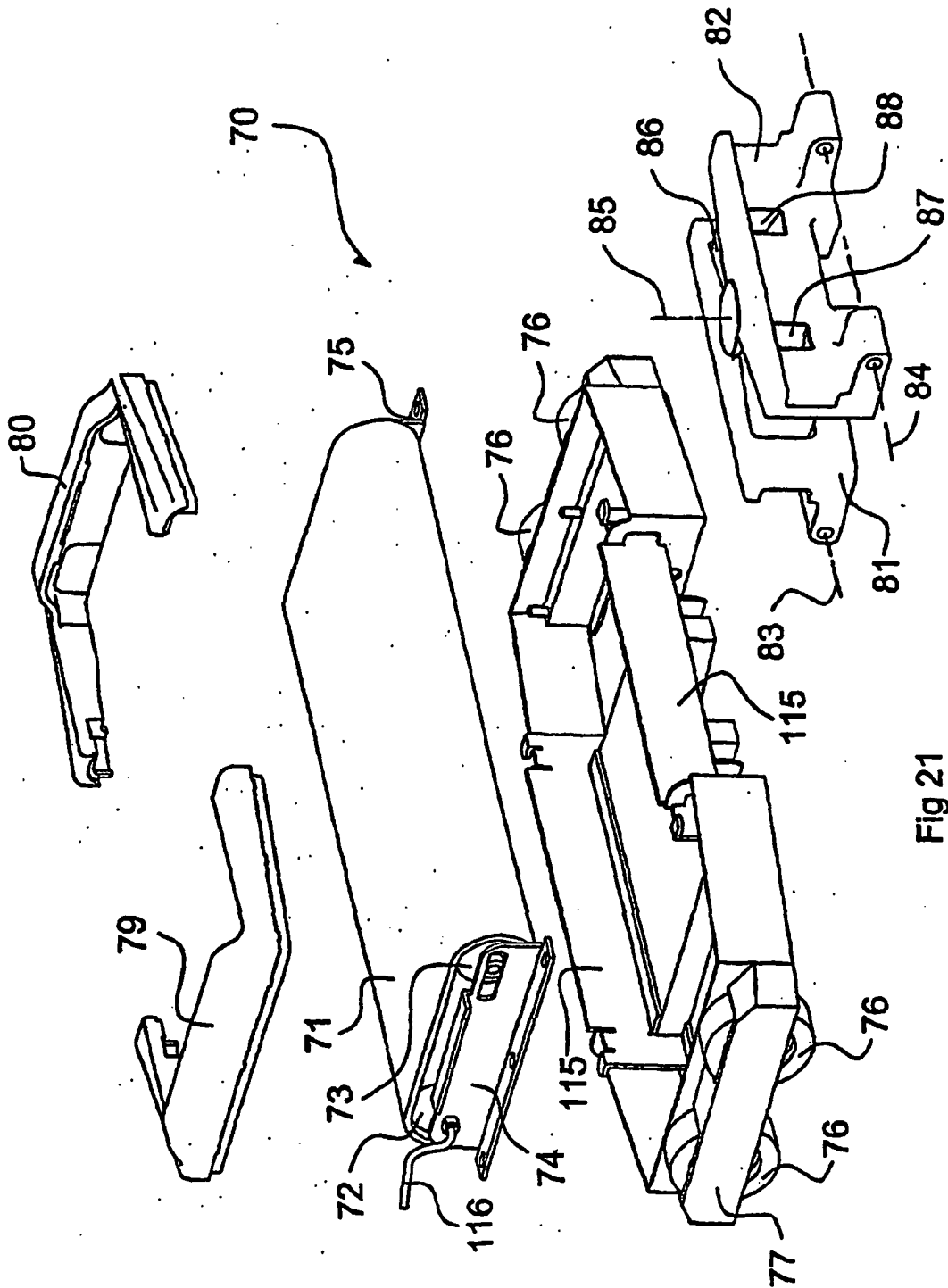


Fig 21

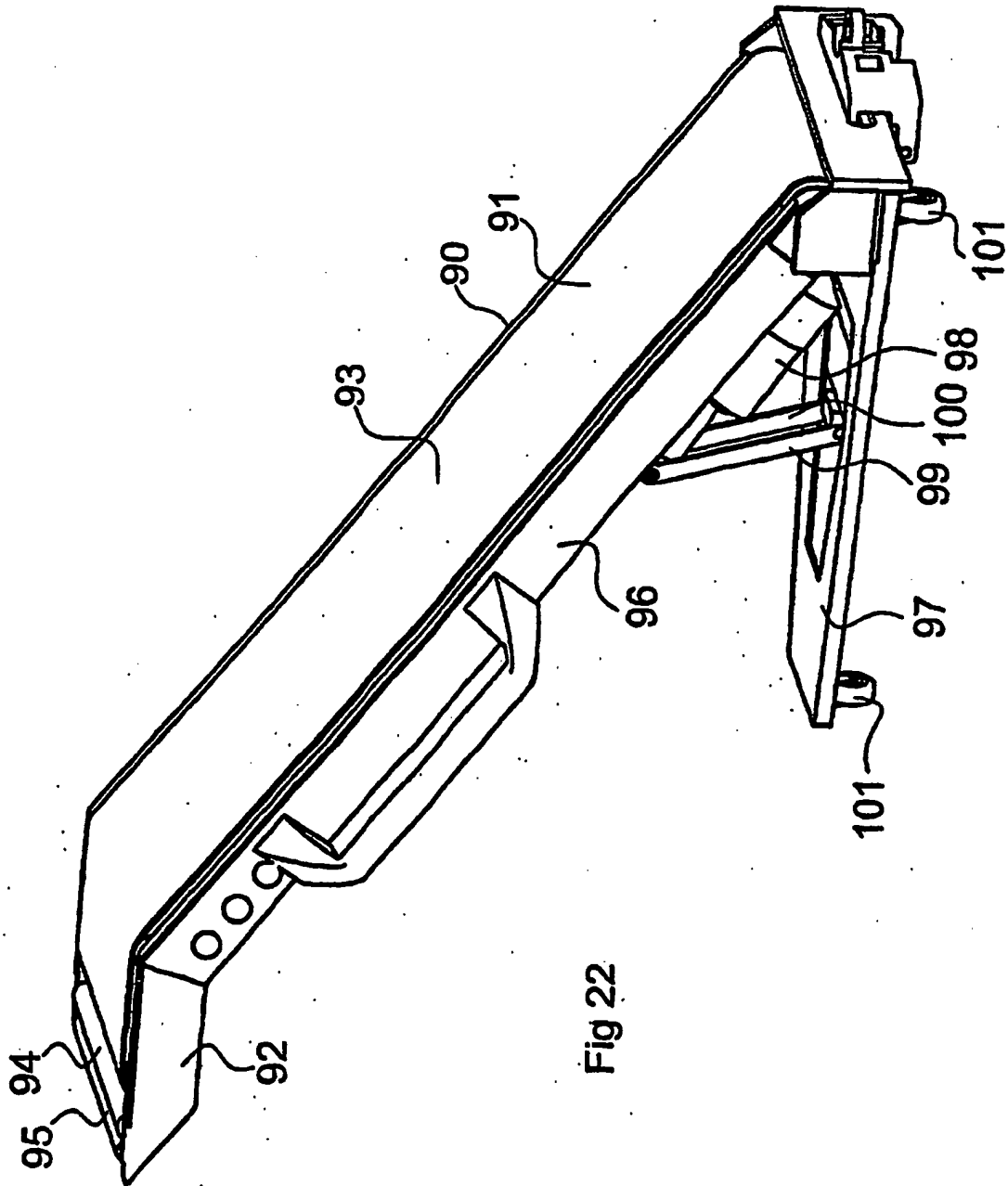


Fig 22

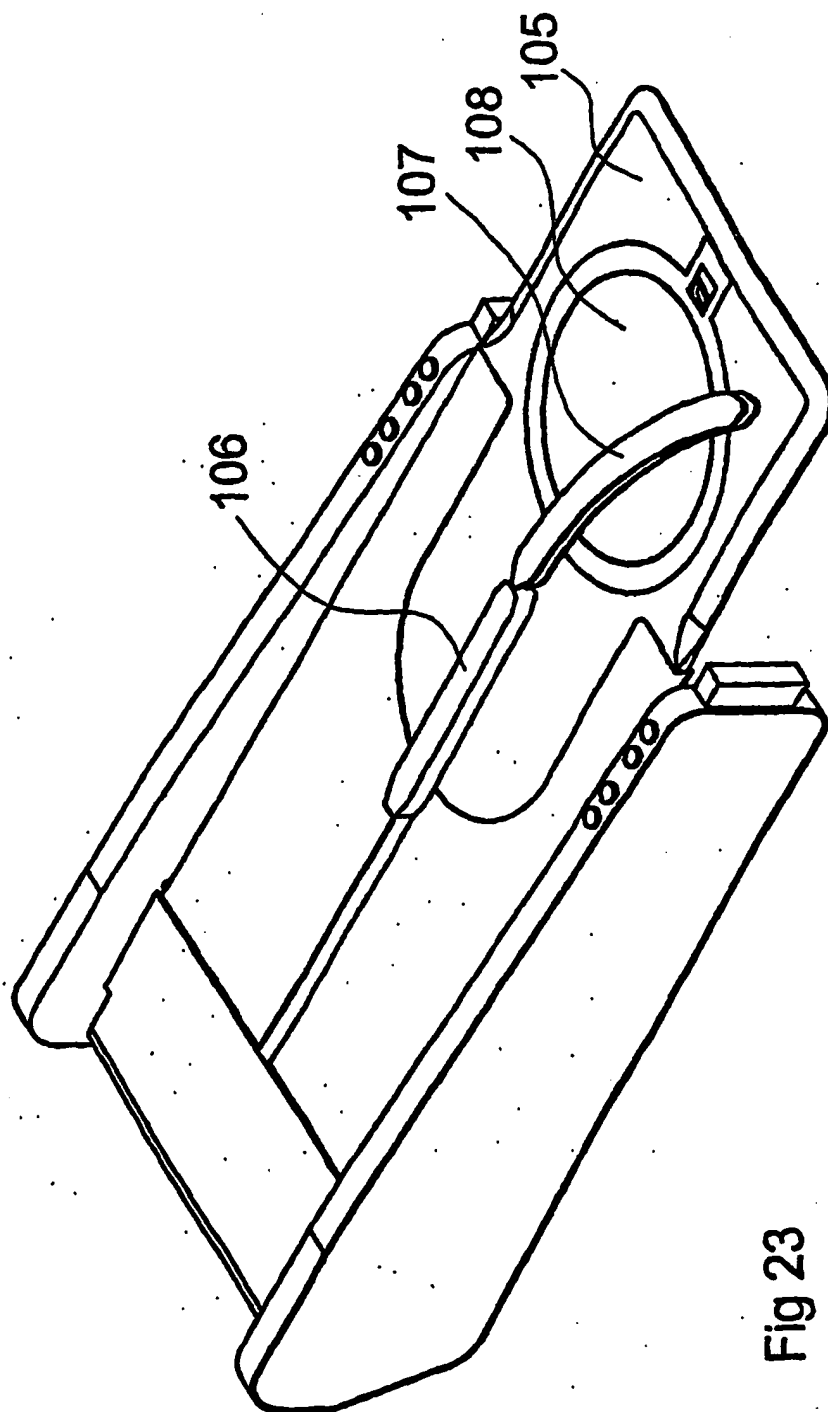


Fig 23

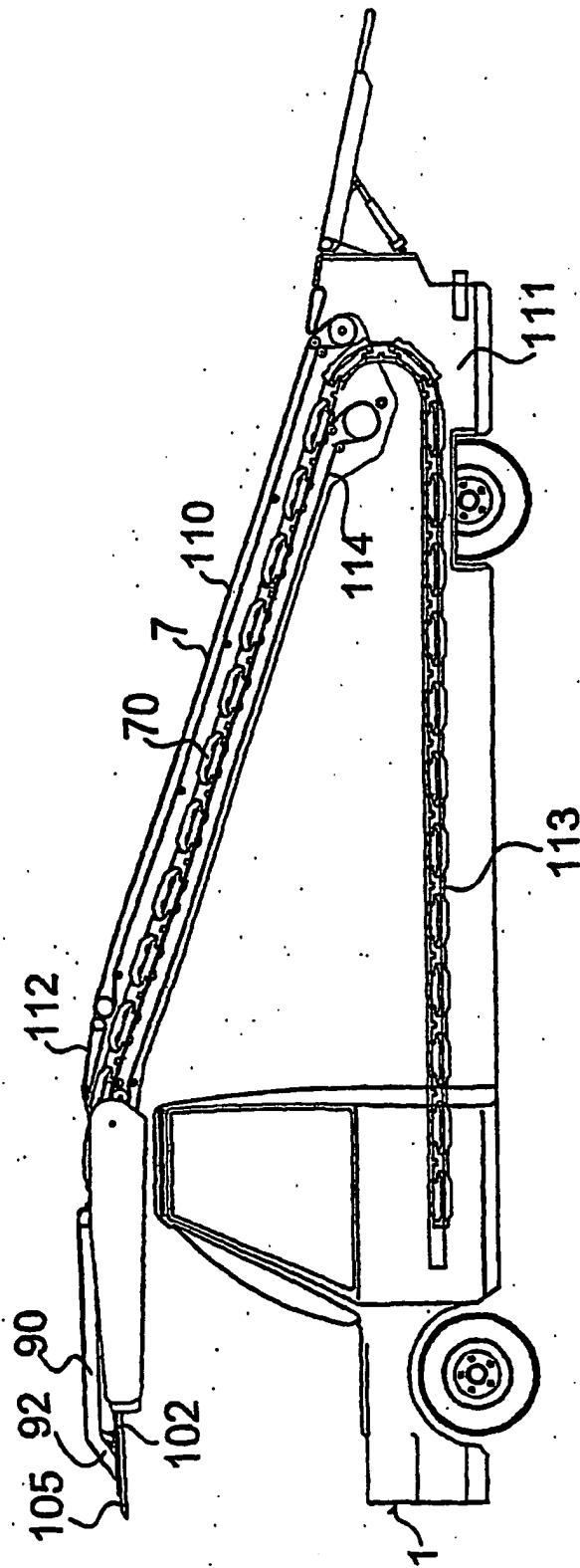


Fig 24